STATUS OF RESEARCH IN AMERICAN GEOGRAPHY

One of a series of ten reports prepared by Committees of the Division of Geology and Geography, National Research Council, under contract with the Office of Naval Research

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FIELD TECHNIQUES

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Chairman

DIVISION OF GEOLOGY AND GEOGRAPHY
NATIONAL RESEARCH COUNCIL
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COMMITTEE ON FIELD TECHNIQUES

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This is one of ten reports prepared to evaluate and describe the current status and future potential of research in various fields of American Geography. The coordinators of the study were Preston E. James and Clarence F. Jones.

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FIELD TECHNIQUES[a]

There are two groups of techniques which are fundamental for geographic study. As presented in the preceding chapter, geographers are especially concerned with those aspects of cartography which are essential for the analysis of area differentiation. This chapter will consider the techniques of study in the field. These two groups of techniques - those of cartography and field study - form the indisputable common denominator which ties together the many kinds of specialists, topical and regional, to be found among professional geographers.

FIELD STUDY

Field study in the pursuit of knowledge offers peculiar opportunities to geography. This fact springs from the nature of the subject in which attention is focused on the patterns of phenomena which characterize areas. This complex of things in situ is observable in the field and by the very nature of the case cannot be removed from its context: location and distribution are essential parts of the data. For the geographer, controlled experiment in the laboratory is impossible; he must himself enter into the midst of the phenomena he is studying; his own senses are the instruments of observation. In the field he confronts and deals directly with his materials in a way for which there is no substitute in the library or elsewhere. Thus geography has greater need for, and opportunity in field study than is the case with laboratory science or even with analytical systematic social science.

In this discussion the term "field study" is taken to mean the gathering of factual information, the recording of impressions, and the formulation of theories of relationships between the various items of the geographic complex within the area of study. The materials of field study come from two sources: direct sense impressions, mainly visual observations, and from interviews with informants.

Whether implied or directly expressed, matters of distribution and spatial relations are a part of every definition of geography. Some of the materials needed may already be available in map form or they can be obtained by interpretation from existing maps. Written and statistical materials may also be manipulated to bring them into distributional form. When the proper information is not available, however, the geographer must gather it himself. His field observations must be recorded, not only for later study but also to determine their distributional patterns over areas too large to be seen from any single point. A field technique is, therefore, a device for obtaining and recording an observation accurately in place. When applied to observations in an area of study, field techniques produce one or more patterns of phenomena of such characters and categories as the investigator has chosen to record. These are the raw materials

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a. Manuscript prepared by Charles M. Davis from material submitted by W. G. Byron, Fred W. Foster, Wellington D. Jones, Preston E. James, Richard F. Logan, and Robert S. Platt.

of geographic study not the finished product; they have meaning only as the geographer gives them meaning in his interpretation of their significance. The ideological differences between geographers arise from the various ways in which they interpret their field facts rather than differences in the facts themselves or the techniques by which they are recorded.

The field approach is not to be regarded as a last resort but rather as the primary one of a number of methods useful for the collection of data necessary for geographic research. Direct observation in the field may be interpretative, corrective, corroborative or supplemental of existing data as well as for the purpose of initiating and developing original information. It is difficult to conceive of the geographer who can effectively use materials in the office without some experience in direct field observation to develop his understanding and sharpen his critical appreciation of the distribution and space relationships of phenomena on the surface of the earth.

In geographic research studies there are four basic methods of gathering information. These are: direct observation of phenomena in the field; interview of informants; interpretation of air photographs; and study of documentary materials, including maps, statistics and photographs. The first two of these are direct field procedures and their techniques are discussed in this chapter. The techniques for interpreting air photographs are enough different from direct field methods that they are treated in a separate section.

Documentary Study

The techniques used in documentary research will not be covered in detail in this chapter. However, this should not suggest that knowledge of documentary methods is not an essential part of a geographer's training or an important tool in areal research. The methods of searching for such sources, of evaluating them, and of selecting relevant material from them, which have been chiefly developed by other social sciences, are essential also for geographic research. In every study documentary sources should be exploited, and in certain cases the whole study must be carried through chiefly on the basis of this method. This is not only true for areas currently closed for geographical field study, but also in certain topics where the statistical record is of basic importance. In the field, also, geographers should be aware of the methods of searching for documentary materials. In the chapter on Historical Geography it is pointed out that documentary sources are best interpreted for their meanings when the investigator actually carries the documents into the field and also that archival findings should be checked by field work.

Documentary research involves two principal operations: locating materials and evaluating them for the purposes in hand. The first of these is bibliographical in nature; its materials are found in libraries and repositories and its techniques are those of employing lists, bibliographies and indexes. In documentary research the preparation of an annotated bibliography is comparable to reconnaissance in field research. The evaluation of documentary materials depends upon the skill and experience of the investigator; in what he can find he must recognize what is important to his objective, must evaluate it for its suitability and manipulate it until it fits the

framework of his purpose. Much documentary material is the product of some other investigator working toward a different objective; it is therefore likely to contain subject interpretations.

From documentary sources a geographer may obtain an initial familiarity with an area that will enable him to fit his observations readily into a frame of reference; this should not, however, constitute a rigid structure of preconception. Comparative statistical analysis of an area may point out both relevant conditions and engaging problems of its geography.

Certain types of information such as that concerned with the numbers and distribution of people and the pattern of land ownership may be obtained by either field or documentary techniques. Where suitable materials are available the documentary method is preferrable because of the time involved in collecting field statistics. It can be argued that the effective use of documentary sources is best done by persons who have had field experience in gathering the kinds of data recorded in the document, or who have intimate personal acquaintance with the area under study.

Field Objective, Field Tools and Field Procedures

The first step in any geographic research project is a clear statement of the objectives. Many years ago William Morris Davis pointed out that a person who looked at things in general would either see nothing coherently, or would see only those items illuminated by his preconceptions. The idea of looking at an area "to see what it is like," of going into the field with a blank mind to search for problems, is generally unacceptable. The blank mind is, of course, a psychological impossibility: in reality the blank mind refers to the uninformed mind which operates chiefly on the basis of preconceived ideas. On the other hand, if an objective is clearly formulated and phenomena relevant to it are sought, a wide variety of factors come to view in coherent if not systematic relationships. To be sure the objective may be rephrased or even completely changed, but at any one time in the course of a field study, the field worker should have an objective clearly in mind. What kinds of matters have been and should be investigated have been indicated in the preceding chapters. The nature of the materials to be gathered in the field is determined by the objectives of the study, but the manner in which they are to be observed and the techniques by which they are recorded differ widely between individual geographers. By whatever techniques this is accomplished the essence of geographic field work is the recognition of certain phenomena, the recording of their distribution patterns for the study of their significance and meaning. This implies that the geographer must have both the ability to observe and the techniques to record his observations. The first of these requisites is a matter of personality, training and experience. There are certain aptitudes that would seem to be attributes of a good field worker. These aptitudes have not been adequately defined. In general we may speak of adjustability: of the capacity to work under all kinds of conditions; to be equally at home in the wilderness or in a strange city; or to accept people and conditions as they are without forming value judgments based on comparisons with conditions at home. But beyond these rather vague qualities of mind, together with the physical stamina which makes carrying them easy, the specific

definition of aptitudes for geographic work have yet to be formulated.

Base Maps and Air Photographs

It is difficult to visualize any field problem in which the distribution of categories of phenomena is not a major factor and therefore in which the cartographic organization of the field observations is unimportant. These observations may be recorded directly in map form through the processes of mapping or they may be collected as notes oriented to a base map. In either case the base map is a primary field tool. For most parts of the world some kinds of base maps are available not always well suited to the objective but at least with some lines and points of orientation. Where none are available or those that can be had are unsuited, the geographer must construct his own. To make a good base map requires engineering training; it is a part of geodesy and surveying and concerns the precise establishment of points and lines. Few geographers possess the necessary skills. Where nothing is available he must improvise.

The most general difficulty in base maps is the fact that they are not made on the scale required by the objectives of the study. As a general rule, base maps are published on scales of one inch to the mile or smaller and in their generalization may eliminate or obscure features which would normally serve as points of orientation. The essential framework of many base maps, especially modern topographic maps, is developed with sufficient accuracy to be used as field sheets in the form of photographic enlargements to the field scale. These enlargements, however, will not carry details of pattern corresponding with the enlarged scale. Enlargement by photographs or photostats produces lens error that increases from the optical center; if this equals one-quarter of an inch at the scale of two inches to a mile, the roads along the margins will be 660 feet too long in each mile.

Base maps are seldom perfect instruments. They contain technical errors and depict conditions at the time they were made which may be many years previous to their use. The original data from which they were constructed have been generalized; hence, two bends in a road may have been amalgamated into one either by cartographer or a road improvement. The geographer will readily recognize discrepancies between what he sees and what is on the map, but the failure of a traverse to close on a base map may be caused either by his own inaccuracy or some fault of the base map, perhaps both.

Quite a different type of base map is provided by a vertical airphoto. In addition to furnishing a large amount of base data, it gives a unique view of the terrain and a resolution of certain distribution patterns that may be of value to the field worker and could be obtained only by much greater effort by ground techniques. Although airphotos and mosaics made from them are superior to ordinary base maps for most geographic field purposes, they too have their deficiencies; chief of these are the matters of availability and cost. The patterns recorded by the camera may not be the ones desired by the investigator and may actually obscure those sought. The use of air photos in field mapping is discussed later in this chapter.

Reconnaissance in Field Work

The initial phase of a field project is a reconnaissance of the area. As used in geographic investigation it is a term of broad meaning that implies a rapid survey for the purposes of becoming familiar with an area, for gaining impressions, for locating critical lines and areas, and for determining categories, scales, and techniques for more detailed work. The techniques suitable for reconnaissance are those which will cover maximum area with whatever intensity is required for the purpose. Automobile traverses along roads, sample studies, and random interviews are common techniques of reconnaissance. Any vehicle that will carry the observer and his base maps can be used, and railroad trains, /20/ boats, and airplanes /22/ have been employed.

The plan for detailed field study and the application of the chosen techniques to sample areas should be the chief results of reconnaissance. In any study of a large area the time and effort spent on these aspects is amply repaid by more effective work over the larger entity. This is especially true where the detailed work is to be done by separate persons or field teams wherein, unless the major problems are identified and provided for by reconnaissance each field worker will define these in his own and, probably, individual manner.

In a strict sense reconnaissance is not intended to produce much material of direct value to the objectives. Its important results are contained in the plan that involves categories of phenomena, scales for field operations, and techniques for collection and recording of the materials. Properly a reconnaissance is preliminary to some other operation. Published field studies of superficial or fragmentary nature have been entitled "reconnaissance studies" but such a designation is more apologetic than accurate. Reconnaissance is not a substitute for other methods but a different procedure which has its own specific place and utility. It requires more experience than other methods since it is implicit that the investigator have a keen appreciation and understanding of the complexities of areal distributions and relationships gained from intensive and detailed field observation. For this reason reconnaissance is often misused and the results obtained are open to criticism. The apparent ease of procedure appeals to those who have not previously prepared themselves for its proper use by an apprenticeship in detailed field observation and who mistake the results of reconnaissance for those of more detailed study.

Reconnaissance procedures are not only preliminary, but also may be conclusive in field studies. Where fact relationships have been established by detailed work in sample areas, those findings may be extended to analogous areas by reconnaissance methods to cover the whole of the district under investigation.

SELECTION OF TECHNIQUES FOR FIELD INVESTIGATIONS

In a general way the character of the observations required for the objective of a field study indicate the techniques by which they may be most efficiently recorded. From the viewpoint of field techniques the phenomena

that compose the surface of the earth may be classified into two groups. The first contains those visible, concrete and commonly static phenomena of either natural or cultural origin which may be directly observed in the landscape and whose patterns may be delineated by the techniques of direct observation: mapping, note-taking, and photography. The second group consists of those phenomena that cannot be directly observed at any single time; it contains such phenomena as population movements both past and present, the patterns and velocities of regional circulation, and the kinetic aspects of human occupance as an active enterprise in its environmental setting. Commonly the patterns of these phenomena cannot be determined from visable landscape evidence and must be sought by inquiry and interview of the inhabitants of the area being investigated.

From this classification the field techniques of geography fall into two divisions: those of direct observation, and those of inquiry of informants. Within each of these classes the nature of the material further indicates the techniques most suitable for use. In direct observations where the categories of phenomena must be given accurate areal expression, the mapping techniques are the most efficient; for nonquantitative presentations, especially those in which movement, velocity, or time factors are important the noting techniques may be much more suitable. If observations are to be recorded by mapping, some one technique is ordinarily better for the job than any of the others. Reconnaissance should have shown the character of the phenomena required, the probable patterns of distributions, and the accessability in terms of roads or other avenues of approach. The geographer knows what base maps or air photos may be had. The problem of selecting field techniques narrows to that of matching work to be done with the available tools, time, and manpower; within the limits of such considerations there is but little choice of techniques. Individual geographers may prefer to work with certain techniques with which they have had experience, and consciously or unconsciously, may find objectives which are suited to these techniques.

THE TECHNIQUES OF RECORDING DIRECT OBSERVATIONS

In field studies, direct observations are recorded by three kinds of techniques: mapping, note-taking, and photography. These are complementary in the broadest sense and the preference of one or another as the principal field activity depends upon the character of the material to be recorded together with the importance of accurate quantitative areal expression in its presentation. When mapping is the primary procedure, notes are used to clarify and explain the patterns delineated and to record facts that are not well expressed cartographically. If the information is to be recorded principally as notes, it is commonly given areal significance through identification on a base map. Photography is a secondary method of recording for reasons that are discussed later. The most satisfactory field work includes the coordinated use of all of these because each has a function that is poorly served by another.

The major part of the following treatment of recording direct observations is devoted to the mapping techniques. This arises from the facts that the methods of mapping are formalized and standardized; the same techniques

have been utilized by different geographers in similar ways; and the published details of these techniques are the general property of the profession. Note-taking techniques, on the contrary are highly individualized. There is little uniformity and almost no published material dealing with their methods. There is also a strong subjective factor involved, which arises from the complexity of the field material and the ability of the observer to retain his impressions of it; geographers in some studies make voluminous notes on the spot, others make only brief records which may later be enlarged. It has not been possible to devise any classification for note-taking similar to that by which the mapping techniques are analyzed.

Mapping

The process of mapping consists of recognizing certain categories of phenomena on the earth's surface, locating and measuring the extent of these, and recording them in much reduced proportion on paper. The result is a map by which a student can "hold the world in his hand" and explore the patterns and relationships that are too large to be directly comprehended in the field. There are, then, three attributes to the mapping process; 1) recognition and categorization of the phenomena, 2) the ratio of proportion, or scale, on which they are reduced to the paper, and 3) the means by which they are located, measured and recorded. Each of these three attributes is in itself greatly varied and they may be combined into an almost infinite number of mapping techniques. It would be impracticable to attempt to list or describe all of those used by geographers through the ages from the measuring wheel of the Egyptian land surveyors to air triangulation of the present. The expositions which follow deal with the characteristics and utilities of the three attributes of mapping with references to methodological and descriptive studies.

The field geographer does not map individual phenomena as such but rather delineates the distributions of categories of phenomena that are essential to the objective; the phenomena within a category have some significant likeness, and any irrelevant differences may be disregarded. The selection and definition of the categories is one of the important tasks of the reconnaissance. As these categories of phenomena are identified in the field, their extent is determined, their positions fixed and they are classified within the framework of a prearranged system. Effective field mapping is a process of recognition of observable phenomena in their natural arrangement and orientation, all in terms of some established criteria. These facts are recorded and identified by keys or symbols. The nature of a phenomena does not classify it; this must be done by the mapper.

The degree of accuracy maintained in geographic field mapping is dependent upon a number of factors including the objective of the study, the time and personnel available, the equipment used, and the scale and the methods employed. So long as a mapper works with an understanding of the requirements of the objective he will maintain mapping integrity. A common error is made in the evaluation of geographic field mapping in terms of criteria applicable to some other kind of mapping, usually of a higher order and hence mathematically more precise in matters of location. It should be considered that an accumulated error of one hundred feet in the closing of a compass and pace

traverse over a square mile of land is no more representative of inaccuracy than is an error of a few inches in the closing of a first order transit traverse over the same area. It is also much less important because the geographer is interested in relative relationships within areas whereas the engineer is primarily concerned with location of points and lines for other purposes.

Few studies in geography indicate the methods employed in the collection of data. This should be a matter of professional concern as the results may create an erroneous impression of the techniques and procedures used. Descriptions of the field methods employed should be included in the published presentation of the results of field research.

Mappable Phenomena

Categories of phenomena to be mapped depend upon the objectives of the field study. Although it is possible to select these in a general way, their details are commonly apparent only after some reconnaissance. Consequently, it is necessary initially to proceed experimentally and it is preferrable to include as much as possible at the start to avoid remapping.

Mappable phenomena may be divided into two major types: 1) areal phenomena which are those that occupy enough area to be shown to scale and bounded with lines; and 2) point and line phenomena which have no area or such small area that they cannot be accurately rendered and must be therefore represented by points and lines. This classification is partly dependent upon scale although some features such as political boundaries are line phenomena on any scale. A difficulty arises in the recording of areas which are too small to be plotted at the mapping scale. These may be such features as orchards, kitchen gardens, mines and the like for which a point symbol shows no area; the mapper is disinclined to include them with a neighboring field of corn or some other crop; yet together they may represent a significant area or item of production over a hundred square miles. The handling of these small entities depends upon the objective; if they are important the field scale must be established to include them, or they must be represented by out-of-scale symbols.

Areal Phenomena occur in either of two kinds of distributions; some, like soil and slope, are continuous; others such as woodlots and cultivated fields are discontinuous, discrete entities. A field mapper may not, however, be interested in a continuous distribution as such and he may map only some of its parts such as steep slopes or muck soils. It is easier to map continuous distributions than discontinuous: in the former the geographer in drawing the boundaries of one category is thereby setting the limits of the surrounding ones; because the separate entities cover the entire area, errors are readily recognized. In mapping discontinuous phenomena the mapper must both delimit the area and also locate it. Discontinuous and continuous phenomena may be readily mapped together because the continuous furnish a locational base for the discontinuous.

Areal phenomena occur together on the land in varying associations many of them are located in a single place but their limits differ.

A mapper may be interested in few or many depending upon the objective of his work. At any location he will recognize and map either categories of single phenomena such as soil, slope, or vegetation; or he will recognize categories in which several phenomena are combined. In mapping combinations he may adopt "unit area" techniques[b] and draw a boundary wherever any one of the phenomena changes in category /4/. Combinations of the physical elements of soil, drainage, and slope, together with the vegetation related to these factors may be mapped together as a "land type" /27/ (Fig. 2).

Although categories of more than one single phenomena may be mapped simultaneously by means of different boundary symbols of overlay (Fig. 1) it should be recognized that a mapper generalizes what he sees and must maintain the continuity of this generalization. Four or five continuous phenomena probably could be mapped at the same time but it is questionable whether it could be accomplished any more rapidly or efficiently than if each were mapped in smaller multiple combinations or even separately.

Point and Line Phenomena are such features as houses, roads, fences, streams and boundaries that have little or no area. In some respects they are relatively easy to map as they have location, direction or both without area. A railroad with its right of way may appear as an areal phenomenon at a scale of 16 inches to a mile and as a line phenomenon at 4 inches to the mile. If such phenomena as these must, by reason of the objective, be given correct areal significance the work of mapping is much increased since this can only be accomplished at scales that show great and sometimes useless detail for other representations. The depiction of the varying widths of a stream along its course or the ground plan of a house presents many difficulties and is very tedious. If it is desirable on small scales to give areal expression to certain line phenomena, the lateral dimension only may be plotted at an exaggerated scale as is commonly done in the mapping of streams.

Field Scales

In a theoretical sense the scale on which field mapping is to be done may be determined by fitting the smallest entity to be recorded to the space necessary to designate it. In practise, however, there are many other factors involved. Some of these arise from the limitations on time and manpower and the availability of base maps or airphotos. The objective of the study determines what must be mapped but commonly the largest practical scale may limit the nature of the actual mapping and to this the objective may have to be adapted.

The problem of scale limitations can often be resolved if the areas demanding large scale treatment are small and scattered. In such instances the scale for mapping may be determined in terms of the grosser features and the general field map can then serve as an index sheet for the smaller entities which are mapped separately at a larger scale.

In single phenomenon mapping where a simple designation is used, a paper area as small as one-eighth of an inch on a side may be delineated; where fractional codes are employed a minimum space approximately one-quarter inch

b. See section on Recording.

on a side is required. For fractional codes the following limitations are thereby indicated;

Scale of 1:63,360 smallest area would be 40 acres,
Scale of 1:31,680 smallest area would be 10 acres,
Scale of 1:15,840 smallest area would be 2.5 acres.

A consummate mapper may work with smaller areas than those indicated but this is generally impractical. Natural distributions are normally irregular in shape and an irregular sixteenth of a square inch presents more difficulties in recording than does a rectangular shape of the same size.

Field scales should be made up in units which will be easily workable in the field. If base maps on the metric system are employed, metric units may be designated in the scale. In those parts of the United States where the land pattern was established by the General Land Office a designation of "chains to the mile" will correspond with the common arrangement of land use units.

Means of Mapping

A means of mapping is a combination of procedures for keeping direction and distance which enable the mapper to know where he is at any place and thus to establish points from which to draw the boundaries of the categories of phenomena he is recording. There are three general classes of these mapping means, differentiated principally upon the amount of base data available to the mapper. These categories are: 1) Traverse Mapping in which location is established from a continuous traverse line that the mapper makes as he procedes; 2) Base Mapping where location is established from an adequate base map composed of points and lines; and 3) Air photo Mapping wherein an airphoto serves the position function in the same way as does a base map. Each of these has particuliar applications and limitations. In general, traverse mapping is fundamental to the others.

Traverse mapping consists of carrying a continuous line of position from a point of departure and closing on a known location which may or may not be the point of departure. A known point may conceivably be established by astronomical observations but it is unlikely that the geographer in the field will possess either the technical skills or the equipment necessary for other than a rough approximation of this and therefore some other point must be found.

The traverse, or line of continuous position, is the main element of control within the field map after the mapper has departed from a known point. From this, mapping is extended laterally by a variety of means as the work progresses. If the line is carried in whatever direction the needs of the moment dictate, the process is referred to as a "random traverse," where it is carried in a regular pattern, it is a "planned traverse." In either of these, mapping is extended outward from the traverse to a position where it meets with an extension from a neighboring line thus giving complete coverage of area. Mapping along a line which does not provide complete coverage is referred to as "strip mapping."

The procedures employed in this kind of mapping, while relatively simple,

are based upon the same principles used in the high orders of mapping but without the refinements and mathematical manipulation necessary for great accuracy in the location of lines and points. There are two basic methods; the compass-protractor and the plane table. In the former, directional azimuths are read from a sight compass and plotted into a cross-sectioned notebook; in the latter, the azimuths are plotted directly along the sighting alidade on the plane table which is oriented by an attached compass.

The compass protractor method is well suited for rough or heavily forested country. In relatively inaccessible places the equipment is less cumbersome and so permits freer movement on foot. Plane table mapping once mastered, however, is normally faster, more accurate and subject to less error.

Distance keeping in both methods of traverse mapping may be done in a variety of ways. Pacing is generally the most practical but it is also very tedious. Other ways may be substituted where necessary. Stadia readings or a surveyor's tape may be used in rocky areas or along lake shores where a constant pace cannot be maintained. In reconnaissance surveys distance of a sort may be computed by timing the more or less constant speed of an airplane, a boat, or even a horse. Another method of traverse mapping is done by plane table triangulation wherein the traverse is carried forward from a carefully measured base line by angular intersections. This is particularly adapted to rough terrain where the constant variation between the sloping and the horizontal distances make pacing difficult and inaccurate.

The locations of point positions away from the line of traverse may be determined by intersection or by resection on two or more known points along the traverse line. With practice, the mapper may develop his sense of distance perception to such a degree that he can estimate with reasonable accuracy distances up to a quarter of a mile. The factor of error in estimation precludes its use for traverse line distances so that its chief application is in mapping laterally from the line. In areas originally laid out by the General Land Office survey, field and property lines will show a marked correspondence to divisions of the mile into halves, quarters and eighths, thus providing a means for making estimates.

Traverse mapping is a basic type of pattern delineation. Its principles should be part of every field worker's training. Some of its features such as distance and direction keeping and accurate estimating are required in any kind of field mapping and for this reason alone, experience in traverse mapping is the solid base of a field geographer's education. Even with adequate base maps or airphotos, a geographer is constantly required to make rough maps at large scales to record the details of things too small to be depicted at the field scale.

Base Map Mapping. Where reasonably reliable base maps are available, the geographer may avoid much tedious work. The use of base maps for reconnaissance, for recording point and line phenomena, for strip mapping and for sampling is obvious. They are also of great help in traverse mapping especially that of discontinuous phenomena. The most commonly accessible base maps in the United States are the topographic maps and planimetric sheets of

the Geological Survey but there are many other public agencies producing maps from which base data may be prepared; among these are the soil surveys, post office maps, sectional aeronautical charts, highway surveys, and national forest maps. The best place to locate base maps is within the field area itself where the local public agencies are likely to have or know about all existing base information and also to have locally produced or corrected maps available. County and city officers and local offices of national government bureaus may have not only the base maps but at times the basic information sought.

The advantages gained by use of a base map are speed in operation and accuracy of location. The field worker is relieved of the necessity of developing the pattern of roads and other features of orientation. One may move with greater freedom within the mapping area with the possibility of picking up a point of known location. Lines can be run without closing; a traverse may be interrupted and resumed along a line of control such as a road already developed on the base.

Because a base map contains a large amount of locational data it may be used in a variety of ways within the limits of accuracy required for the ordinary geographical field study. Commonly roads form the base for a traverse and an automobile the distance-keeping function (fig. 2). This combination is especially effective in those parts of the United States where the General Land Office pattern has resulted in straight roads at regular intervals. Very satisfactory intersection can be done for distances up to one-third of a mile with a telescopic aledaide using a half mile of straight road for a base line.

Various adaptations of the base map-automobile combination have been used in field mapping. A plane table may be set up on a light truck or even on the top of a passenger automobile and orientation of the table may be accomplished by a backsight along the road even if the compass is affected by the automobile. In this type of mapping careful notation is made of prominent features that would serve as resection points; silos, windmills and similar point phenomena are good checks whereas corners of woodlots, fields and hilltops are poor because from some other sight angle they may not be evident or appear to be different. A pair of high powered field glasses make these identifications much more easy.

The techniques of using the automobile-base map combination have been developed for many kinds of boundary finding problems. When a boundary can be recognized and indicated on the base map along a road, it is relatively easy to follow it with a pace traverse to its next appearance on a road. If the road net is close enough, very little foot mapping may be necessary. This method is excellent for establishing areas of homogeneity for sampling purposes for delineating land types (Fig. 2), for "network" traverses, and for locating cultural features that are associated with the road system /5/.

Base maps have been used in combination with airplanes both for reconnaissance /20/ and for actual mapping and from boats for mapping swamp areas /6/. In preparing depth contours of lakes a base map of the lake outline is

commonly constructed and boat courses laid out between recognizable shore features; along these the position of the boat is established by intersection from a third point each time a sounding is made.

Urban mapping differs from other cover mapping in scale, categories and the occasional addition of the vertical dimension. It is commonly done on large scales on base maps available for municipal departments or on the atlases used by insurance companies. Airphotos and mosaics make excellent bases /23/. The detailed character of these base maps makes the distance and direction keeping functions of the mapping techniques of relatively small significance; any street corner on an urban map becomes a closing point so that orientation is readily maintained.

The most common type of urban mapping done by geographers is the delineation of functional zones in cities /4/. This is accomplished by direct observation of the various kinds of utilization which are identified by keys and recorded on the base map using the pattern of city blocks as a framework (Fig. 3). A careful and quantitative definition of categories is required in this type of mapping. The recording of the vertical dimension to give volumetric significance is relatively much more important in urban than in rural mapping. This dimension may be readily recorded by appropriate key symbols in the mapping but is difficult to represent cartographically in the finished presentation. This may be represented by a series of maps each showing utilization at a separate story or level, or by cross-sections that present the vertical and only one horizontal dimension/19/.

Many of the maps necessary to urban study are made from documentary rather than field sources. Maps and cartograms of urban activities such as traffic and pedestrian movements are actually sampling techniques in which statistics are collected at selected points and plotted upon base maps of the city.

Airphoto Mapping. The rapid development of aerial photography after World War I brought to field geography a most important new tool. Many of the patterns of phenomena which geographers had laboriously delimited by ground methods now became automatically available for study through the pattern resolving property of the vertical airphoto. A large increase in the amount of base data available on an airphoto in contrast to an ordinary base map almost eliminated the problem of keeping constant location; a great amount of the work of boundary-making was done automatically. Mapping on an airphoto becomes principally a matter of annotation of the features recognized on the ground. The economies of time and expense in wide-coverage surveys offered by the airphoto were recognized and techniques for utilization established. The Michigan Land Economic Survey continued its single category inventory by the use of air mosaics and automobiles /9/. The Land Classification Section of the Tennessee Valley Authority adapted unit area methods to air mosaics and automobiles in 1935-38 /11/, and more recently (1949-52) the work of the Land Utilization Study of Puerto Rico /18/ has been prosecuted by a similar technique. It is now impractical to do any complete coverage in land utilzation or classification of anything except sample areas solely by ground methods.

The use of vertical airphotos as mapping bases is significantly

different from their interpretation as sources of direct material. In mapping, the observer recognizes a complex of phenomena on the ground as forming an identifiable pattern of tone density on the photograph and marks its limits as the boundaries of the phenomena complex; he can see the phenomena and the photograph furnishes the distribution. In direct interpretation the operator must decide which phenomena are represented by the tone patterns of the photograph. In field practice these two aspects are blended: the mapper must interpret the photograph when the pattern boundaries are beyond the range of his vision, and direct interpretation without some ground observations is relatively incomplete and unsatisfactory.

Much of what has been stated above in reference to the utilization of base maps applies also to airphotos when used as mapping bases. The mapping may be done either directly on the photograph or the photograph may be used to orient collections of observations recorded as notes. The differences between mapping on airphotos and noting on airphotos lie chiefly in the restriction of categories and the formalization of the recording system.

In no phase of field operations are airphotos of more value than in reconnaissance; they enable the field man to observe beyond the range of his vision, to trace critical boundaries and to select sample areas with accuracy and dispatch. For such purposes mosaics are preferable to separate prints; the Photo Index sheets furnished at small cost by several government agencies in the United States are almost ideal for reconnaissance in areas of a few hundred square miles.

To the geographer engaged in an individual field problem the disadvantages of using airphotos lie chiefly in their costs and in the difficulties of obtaining suitable prints. There is airphoto coverage for most of the United States but even at the low unit cost of the separate prints any extensive areal coverage represents a significant aggregate expense. In direct mapping, the scale of the print is necessarily the field scale but this may be altered by photographic enlargement or reduction. The specifications of airphotos for various kinds of geographic field enterprises have not yet been worked out and constitute one of the important frontier topics in their adaptation to geographic purposes. For many geographic objectives the accuracy with which airphotography is done for photogrammetric purposes is not necessary. Where a reasonably good base map is available vertical or near-vertical photographs by hand cameras from light airplanes following MacFadden's technique for obliques /16/ would seem to be a most satisfactory way of obtaining photographs for several type studies in an analytical field problem.

System of Recording Field Observations on Maps

The many ways in which geographers record their field observations on maps may be classified into two principal groups: 1) Single Phenomenon Methods and 2) Unit Area Methods.

In the single phenomenon methods, categories of a single phenomenon are recognized, measured and delineated to scale on the field map. Although more than one may be mapped at the same time by means of multiple field sheets,

overlays, or different kinds of boundary lines, the basic procedure is to treat each separately. This involves the complicated matter of keeping in mind the several systems of categorization being employed and the individual amounts of generalization required for each phenomenon. This method is very common in geographic field undertakings; it is the way by which maps of soil, surface types, cover, agricultural types, urban functional areas and many others may be recorded. The techniques are so well known and commonly used by the earth scientists and other researchers as to need no elaboration here. They are well exemplified in the work of the Michigan Land Economic Survey /24/

In single phenomenon mapping elaborate or complex keys are rarely necessary; a simple letter or number will commonly suffice. This permits smaller minimum areas to be mapped on any field scale than if a complicated designation is required. In some of the Michigan Land Economic Survey mapping a "pseudo-fractional" designator of the following character:

$$\frac{W\text{-}N\text{-}J}{12\text{-}18'' \quad 1\text{-}3''}$$

indicated that the vegetation cover consisted of white, norway, and jack pines in that order of dominance; and also that there was a thin stand of trees of 12 to 18 inches in diameter together with a thick stand of smaller trees, one to three inches in diameter.

Unit area techniques, a distinct contribution of American geographers to the methods of areal analysis, have been mentioned previously. The concept was originated with a group of midwestern geographers who met regularly each spring in the field to discuss techniques. Various members of the group tried out the methods suggested; in 1933 Vernor C. Finch published the techniques of the first unit area method under the title "Geographical Surveying" /7/ and also an example of its application, "Montfort" /8/. In the unit area technique the mapper visualized the earth's surface as composed of small units each containing a uniform association of chosen phenomena. Wherever a change is detected in the categories selected for any of the composing phenomenon a boundary line is drawn. The result is the division of the area into a mosaic design of complex units, each small enough to be substantially uniform in all chosen natural and cultural phenomena. The drawing of a boundary whenever a type change occurred if followed to its ultimate would have resulted in unusable complexity, so that a minimum area was established and units smaller than this were generalized with neighboring ones.

Each unit area was identified by a fractional code in which the numerator represented conditions of land use and the denominator of environmental factors.

$$\frac{\text{Major Use Type} - \text{Crop or Use} - \text{Condition of Crop}}{\text{Slope} - \text{Soil Type} - \text{Condition of Drainage}}$$

The first digit of the numerator indicated four major types of land use: 1) tilled land; 2) permanent grass; 3) timber; 4) idle land. The second

digit indicated the specific crop or use, but identical numerals varied in meaning, depending upon the preceding category. Thus a 2 as the second digit would indicate "oats" if the first digit were 1, or "pasture with scattered trees or brush" if the first were 2. This is the only case of non-uniformity of meaning for specific digits in the system, however.

Because each of the phenomena that compose the complex has its own distributional limits and these seldom coincide exactly there are a great many marginal complexes too small to show on the field scale that must be allocated to one or the other of their bordering larger entities. This is also true of single category mapping as stated earlier, but in unit area methods the number of phenomena handled simultaneously makes this marginal problem of much greater proportional significance.

The data when finally plotted on a map, were so complex as to be virtually uninterpretable; (Fig. 4) but from them, by coloring or shading methods, the distribution of many single digits or combinations of digits could be graphically portrayed on separate maps. The whole system, then, was not intended to become an end result in itself but rather a means to an end; a tool for recording data from which interpretations and correlations could be made. Aside from the practical convenience of recording all data on one map, the device had the basic merit of recording the geographic complex of phenomena in their essential local association.

The unit area technique used by the Land Classification Section of the Tennessee Valley Authority (1935-39) consisted of an adaptation of Finch's Montfort method to airphoto and automobile mapping (Fig. 5). The minimum size of the land unit was increased to 200 acres and this, on the mosaic scale of one inch to 1,000 feet, gave space for a complicated fractional notation of features selected for their value in land planning. The numerator of the fraction related to land use and the denominator to the physical factors of the land base. This resulted in a "long fraction" consisting of these elements:

Major Land Use - Crop - Field Size - Am't of Idle Land - Farmstead Quality

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Slope - Drainage - Erosion - Stoniness - Rock Outcrop - Soil Depth - Fertility

In all cases except those relating to crops (shown by letters), numerical digits were employed, with 1 indicating the best quality and 5 (usually) the worst. Thus it is possible to scan a fractional notation and determine at a glance that, generally, conditions were excellent, fair or poor. Such generalizations were commonly made, as a means of appraisal of the area by studying the digits of the numerator and denominator separately. Such appraisals were made in the field by the workers who summarized the digits of the denominator and placed the area into one of five categories on the basis of agriculture quality as indicated by the existing physical conditions. Similarly the numerator was summarized on the basis of effectiveness of the present agricultural use of the land and the prosperity of the inhabitants. These classes were indicated by the numerals 1 to 5 in each case, resulting in a

"short fraction."

As a final step the land was appraised by the field worker, and placed in one of five categories, according to the relative severity of the agricultural problems. This was designated by means of a Roman numeral representing essentially a summary of the long and short fractions. These final generalizations made the results of the study readily useable (Fig. 6) whereas the precise, detailed information was contained within the long fraction. The field mapping of the study of the land utilization of Puerto Rico /18/ is similar to that of the Tennessee Valley Authority work but contains a comprehensive key adapted to conditions of Puerto Rican land utilization.

NOTE TAKING

Memory cannot be relied upon to hold for long either the details of observed field phenomena or the broad generalities; items of complex relationships must be made matters of record soon after they are observed. Notes serve not only as means of bringing information back into the office but also of carrying it from place to place in the field permitting comparisons to be made between present and earlier observations. Notes are here taken to mean any kind of written records other than those produced by mapping; they include diagrams, cross sections, and sketches.

Notes as Primary Recording Techniques

There are many kinds of undertakings where observations are better recorded by notes than by mapping: the field aspects of studies in historical and political geography and many of the economic phases are examples. It is difficult to express cartographically the seasonal differences in the activities of an agricultural landscape or the features which lend to some Ohio towns a "New England aspect." The characteristics both static and kinetic which a kind of culture living in an environment produce upon the land may be recognized without mapping analysis and evaluated verbally. Where the field objective is to show nature and extent of an occupance type, notes keyed to a base map are a much more effective method than mapping for recording the observations. Coverage mapping of large areas is impossible to an individual geographer so that he is forced in any extensive analytical project to make detailed type studies and extend these by reconnaissance and noting techniques in the field. James /13/ points out that on scales much smaller than 1:1,000,000 it is not possible to record direct observations because the largest area one can see is too small to show at scale. In studies on such scales, therefore, direct field material must be collected in note form. Whether or not type studies have been mapped the observer records by note his interpretations of the meanings and significances of the phenomena rather than their actual nature and distribution; analysis is done in the mind and the results rather than the facts are recorded. In many situations and at any scale the character of areas may be more apparent when viewed alive in the field rather than later in the office from field maps.

Note taking is not developed on any such standarized procedures as is mapping. For the individual geographer who intends to interpret his own notes

it is necessary only that they recall to his mind the field scene and his immediate thoughts about it (Fig. 7). Some field workers make only the briefest notes on the spot and enlarge these as soon as is practical. In team projects a certain amount of uniformity and therefore standarization must be employed to secure comparable results. It is not likely that geography will ever adopt the rigid and formalized noting systems employed by surveyors and engineers. The great diversity of objectives and variety of techniques coupled with individual interests probably make any standarized system undesirable.

The results of many field studies in which the observations were recorded primarily as notes are presented cartographically at small scales on base maps and, conversely, the significance of much material recorded by mapping is presented verbally.

Notes as Adjuncts to Field Mapping

The map imposes limitations on expression. This is inherent in the scale and categories of all mapping activities. Notes, on the other hand, provide an unlimited opportunity for expanding upon the factual and conjectural aspects of any situation under investigation. They permit the field worker to describe, to interpret and to speculate at such lengths as are necessary for his future information. Notes also clarify those aspects which are obscured or eliminated by scale limitations. Furthermore, the need for proceeding systematically with the collection of data required by the mapping objectives precludes the development of other less important elements in map form.

Notes of summation are made from time to time, most effectively at the close of a particular phase of investigation when the observations are currently in mind and the situation can readily be reviewed in the field if necessary. They bring a freshness of viewpoint and a renewed validity to the manipulation of the field data in the office at a later date.

Sketching, Sketch Maps and Field Diagrams

In field operations many items are best recorded by various kinds of pictorial notes. Examples of these items are physiographic features which are too large or obscured for photography, phenomena distributions, where quantitative areal expression is unimportant, and generalizations which are best expressed pictorially. The techniques by which such items are recorded include sketches, sketch maps, and field diagrams.

Field sketching combines observation with technical ability in graphic art. To the geographers of half a century ago, particularly the physiographers, it was a primary field procedure but has now been largely replaced by photography. Sketching enables the field worker to portray selected features of interest and to omit irrelevant detail, to alter the scale in parts of the sketch, and to annotate significant facts. The basic aspects of the technique are not difficult to master /21 and 25/ but artistry is an important factor and publishable field sketches depend heavily upon this quality (Fig. 8).

Sketch maps are hasty field records of distributions in which relative

rather than exact scale representation is sufficient. They may be made by ordinary traverse techniques but distances and directions are either estimated or only roughly measured. They are designed for later study and are not commonly published. Their principal utility lies in preserving details that cannot be shown on the field scale or by a simple note (Fig. 9).

Field diagrams are not strictly diagrams; they are graphic representations of generalizations arrived at from observation rather than statistics; perhaps they are closer to cartograms. They are intended to record characteristic occurrances or relationships of phenomena rather than specific instances. Field diagrams may be in either map or cross-section form; (Fig. 10) because they deal with generalizations the scale of presentation either horizontal or vertical may be distorted for better effect. Field diagrams are summary devices of great value in both reconnaissance and in the finished presentations of field studies.

PHOTOGRAPHS AS RECORDING DEVICES[c]

The camera is an impression instrument capable of recording critical field observations. Its product, a pictorial note, is unique in its non-symbolic illustration of a relatively small unit of earth-space at a moment in time. Photographs may be used to advantage wherever a view of reality is necessary to document the cartograpic or verbal symbols which have been invented to describe the geographic components of area. Because photographs do not discriminate the relevant from the irrelevant, and because reality may be distorted by subjective factors, photography is complementary to other field techniques. It is sufficiently important, however, to be considered a basic field tool.

Field photography includes an unlimited range of subjects organized about a definitive set of concepts. Good geographic pictures are those which represent the areal or volumetric relationships of relevant associated phenomena. This concept is the basic thread which provides unity in the photographic interpretation of the elements of form and distribution.

The isolation of phenomena into type studies of individual features is contrary to the philosophy that geography deals with the significance of area differentiation. The photographic representation of the form of single features can be defended only where the author is prepared to illustrate a variety of features with similar functions. Such an approach is likely to be sterile if the type studies are not subordinate to the broader spatial relationships which exist from place to place.

If photography is to be properly exploited, the geographer should be a versatile and competent photographer. He must be able to identify those areas

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c. Manuscript prepared by William G. Byron

where it is desirable to record relatively undistorted reality and to reproduce an acceptable photograph which clearly expresses the purpose for which it was taken.

The best geographic pictures are generally those taken of a subject at a medium distance. This may be defined as that distance where associations of phenomena may be readily identified from the photograph. When the subject is farther removed, the distinct advantages of photography are lost, and a sketch, map, or written account can be used to better advantage. Closeup photographs are useful as note supplements but rarely can be used to advantage in publication. Such pictures either reveal form in unrelated isolation or a stage of a process which cannot be understood without a sequence of pictures through time.

Good geographic pictures should be able to withstand certain critical challenges:

1. Does the picture document a concept or is it irrelevant?
2. Can the picture be defended as a representative sample of the site and situation which it purportedly portrays?
3. Do unrelated phenomena obscure the main subject?
4. If the picture is for publication is it technically sound?
5. Can the scene be precisely located on a map?

In recent years technical advances have made new field photographic methods possible. Oblique aerial photographs may be taken by the individual with comparative ease /16/ (Fig. 11). Microfilm and other devices for copy work have become the fastest practical field method for extracting documentary evidence. The recent perfection of an instantaneously developing camera should increase the value of field photography as a recording procedure. If an investigator can take a picture, develop it on the spot, and dry it well enough to write upon it an interpretation of the features it shows, he will have a written and visual record of great significance. Color, infra-red, and ultra violet photography have demonstrated advantages with many more possibilities yet to be pioneered. The geographer who understands the scope of photography and its application to field work will recognize the advantages of the medium in perspective with its inherent limitation.

THE INTERVIEW OF INFORMANTS

The third method of gaining information and developing ideas concerning geographic problems has to do with the interview of informants. An informant is a person who possesses either specific factual knowledge, or has ideas or opinions concerning the problems of an area which are considered worth reading. This is a method widely used by geographers in field studies, but one which has been developed chiefly by anthropologists, sociologists, and others.

Two most important of the techniques by which geographers secure material from informants are the questionnaire and the interview. Selection of one

or the other of these depends primarily upon the required information: where this is quantitative in nature and questionnaire is preferred to the interview. The range of the informant techniques extends from the formal questionnaire to be filled in by the respondent, to the informal interview.

These techniques may be applied either to all individuals in the area or to a selected sample. Complete coverage is desirable where possible and to secure objectives is essential because the results may be shown cartographically in detail. The use of sampling methods requires that the sample group be so chosen that it effectively represents the larger entity.

Questionnaires

There are three important steps in using questionnaires for field purposes. These are: 1) The preparation of the questionnaire, 2) its administration and 3) the evaluation of the results. The third of these, like the evaluation of other field findings, is an office procedure omitted from this presentation of field techniques.

A questionnaire must be made up in such a way that it will produce the information required for the objective of the study. This is ordinarily clear to the investigator but seldom to the respondent. When the questionnaire is to be filled in by the respondent alone it must be carefully scrutinized from his viewpoint. For example, the question "how much land do you cultivate?" may be interpreted to mean the acreage in his farm, the acreage that is tilled with or without rotation pasture, or the acreage in clean-cultivated crops as contrasted to those which are not cultivated. Questionnaires addressed to individuals should require only information which is readily available. If much effort or statistical compilation is required to complete a questionnaire, dependable returns may be expected only from public officials or from organizations which have some interest in public relations /17/. Very good results were obtained from a mail questionnaire asking the wood-using industries of Iowa for the sources of their lumber /1/ and another to county assessors requesting the number of recreational establishments in their district /10/. If the questionnaire can be made to include items in which the respondents will be interested and a promise of distribution of the results made, an incentive for responding is included. Considerable information upon the preparation of questionnaires for direct response has been published, chiefly by market analysis investigators /2/. Whenever possible a questionnaire should be tested by a sample application and revised in view of the defects thus revealed. Some idea of the expected returns may be had from these trial applications.

There are two principal methods of administering questionnaires. The first of these is by direct distribution to the respondent who fills in the required information and returns the questionnaire. The other method is that of administration through an interviewer who records the facts as stated by the respondent. Whenever practicable the second type produces better results. It assures a more complete response and avoids errors of misinterpretation by the respondent. Direct questionnaires are most effective when addressed to public bureaus and officials, to large business organizations, and to schools.

They are least effective when addressed to individuals who have little interest in the information being sought.

The administration of a questionnaire through an interviewer combines the techniques of the questionnaire with that of the interview. This is the means by which the United States census is compiled for each decade. Questionnaires administered through interviews should contain relatively few and simple facts and figures of a kind which involve the respondent personally and on which he is an authority. The facts about himself, his activities, his possessions, his personal history, and matters on which his opinion is that of an expert are the ones which are readily given. The excellent example is found in the work of Kurath /15/ and his associates in compiling linguistic patterns by interview-questionnaire. The questionnaire accomplished through an interview is the most versatile of the informant techniques because it allows exact quantities to be recorded and also additional information to be obtained (Fig. 12). In some instances, by careful preparation, the validity of the quantitive material may be checked by other questions. A very large amount of the public opinion gathering in the United States is done by the questionnaire-interview technique and an extensive bibliography on the method is available /26/.

Interviews

Interviews are different from direct questionnaires or the questionnaire-interview, in that they are intended for the accumulation of impressions rather than quantitative information. This distinction, is not always clear-cut. An interview is a conversation that the interviewer directs toward the facts that interest him. Commonly the results are recorded later because notes taken during the interview retard the spontaneity of the conversation.

Interviewing requires that the investigator acquire considerable experience before he can obtain entirely satisfactory results. The beginner is likely to ask questions so phrased as to bring the answers he wants.

The techniques of interviewing may be used for three general purposes in field operations: for reconnaissance, for coverage, and to check field findings. These uses vary principally in the manner of their application rather than their techniques.

Interviews of reconnaissance nature are those by which an investigator seeks general information about an area or the nature of its problems and conflicts. They may be random conversations with inhabitants or deliberate interviews with selected and well informed persons. In such interviews the investigator must have well fixed in his mind the points of his interest and must direct and redirect the conversation toward these. The value of such interviews comes primarily from concurrence of opinion on certain matters and it is therefore essential that the critical items be covered in each instance. Notes covering these items are ordinarily made after the interview is concluded.

Coverage interviews are those intended to produce the main body of informant information as contrasted to those of reconnaissance character; they differ only in the fact that coverage interviews are intended to include all

of the inhabitants of an area, or a statistically selected sample of them whereas reconnaissance interviews are ordinarily more at random. There is a relatively extensive bibliography on the methodology of interviewing for social science projects so that details need not be set down here.

The process of deriving a sound sample for interviewing purposes is covered in handbooks on public opinion sampling, and is not here given in detail. If the inhabitants may be considered a homogeneous group in terms of the questions to be asked a sample may be selected from a numerical listing. If areas of significant groupings are involved homogeneous sampling areas should be delimited and sampled.

In coverage interviews a representative segment rather than especially well informed individuals of the population is being treated. Therefore the questions must be framed for the average person. Public opinion polls in the United States are so made as to require only one of three answers (yes-no-undecided), but within the freedom of an interview, more latitude may be allowed. Complex questions, however, are best treated indirectly. If attitudes can be arranged on a scale of concrete example they can be expressed quantitatively even by inarticulate people. James[d] cites an example of this from Brazilian experience. The problem was to determine the attitudes of people toward various economic groups. The question was framed as follows: "How would you feel if a person in each of the following economic groups were to ask to marry your daughter?" The groups were listed as: doctor, salesman, army officer, porter, common laborer, lawyer. The respondent was given the choice of the following replies for each group: "welcome with enthusiasm," "accept willingly," "accept but not happily," "refuse." With this device the attitudes of the people can be measured against a scale.

Interviews to check field findings are those made to validate the results of other field work. As an example, if a certain type of land use is identified as existing in a sample area, its limits may be determined by conversational interviews along the axes of apparent extension. When a field study has as its objective the description of the functional pattern of an area, it is worth while to check the conclusions which the investigator has reached against the knowledge of the inhabitants of the area whether or not any of the informant techniques have been used in the investigation.

Information obtained from informants is an ancient source of geographical field material. Since early Greek times, and probably before, investigators learned how people live by asking them questions. It seems probable that more of current geographical literature is derived from informant than from mapping sources, but the techniques are seldom described. It has been through the work of other social scientists that such formalization as now exists has come about.

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d. In a manuscript.

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